



Original Article

Study on Serum Sodium Levels in Dengue Fever in a Tertiary Care Centre

Bhargav Chandra Nagalla^{1*}, Yugandhar Tummala², M Satya Pratik³

¹Senior Resident, Department of General Medicine, Malla Reddy Institute of Medical Sciences, Hyderabad, Telangana, India.

²Assistant Professor, Department of General Medicine, Malla Reddy Institute of Medical Sciences, Hyderabad, Telangana, India.

³Associate Professor, Department of General Medicine, Malla Reddy Institute of Medical Sciences, Hyderabad, Telangana, India

 OPEN ACCESS

Corresponding Author:

Dr. Bhargav Chandra Nagalla
Senior Resident, Department of
General Medicine,
Malla Reddy Institute of Medical
Sciences, Hyderabad, Telangana,
India.

Email:
bhargavchandra92@gmail.com

Received: 20-02-2026

Accepted: 25-03-2026

Available online: 12-05-2026

Copyright © International Journal of
Medical and Pharmaceutical Research

ABSTRACT

Background: Dengue fever is an acute mosquito-borne viral infection commonly prevalent in tropical and subtropical countries. It is characterized by fever, myalgia, arthralgia, abdominal pain, rash, leukopenia, and lymphadenopathy. Electrolyte disturbances, particularly hyponatremia, are frequently observed in dengue infection and may contribute to increased disease severity, complications, and mortality. Early identification of sodium imbalance may help in timely intervention and improved clinical outcomes.

Aim: To estimate serum sodium levels in dengue patients.

Objectives: To determine the prevalence of hyponatremia among dengue patients & To assess the correlation between hyponatremia and severity of dengue infection.

Materials and Methods: A hospital-based cross-sectional study was conducted among 50 confirmed dengue patients admitted to the Department of General Medicine, Malla Reddy Institute of Medical Sciences, Hyderabad, from September 2022 to December 2023. Patients above 18 years diagnosed with dengue fever, dengue hemorrhagic fever, or dengue shock syndrome were included in the study. Serum sodium levels were estimated at admission, and patients were evaluated clinically and serologically using NS1 antigen, IgM, and IgG tests. Statistical analysis was performed using SPSS version 26.0, and a p-value <0.05 was considered statistically significant.

Results: The mean age of the study participants was 45.3±14.7 years. Males constituted 58% of the study population, while females accounted for 42%. NS1 antigen positivity was observed in 64% of patients, IgM positivity in 80%, and IgG positivity in 18% of patients. Hyponatremia was present in 64% of the study participants, while 36% had normal serum sodium levels. The mean serum sodium level was 126.1±16.1 mEq/L. Mild hyponatremia was observed in 32% of patients, moderate hyponatremia in 12%, and severe hyponatremia in 20%. Complications were more common among patients with severe hyponatremia. A statistically significant association was found between hyponatremia and dengue severity (p<0.001), complications (p=0.005), and mortality (p<0.001).

Conclusion: Hyponatremia is a common electrolyte abnormality among dengue patients and is significantly associated with increased disease severity, complications, and mortality. Routine monitoring of serum sodium levels in dengue patients may aid in early identification of high-risk patients and facilitate prompt management to reduce morbidity and mortality.

Keywords: Dengue fever; Hyponatremia; Serum sodium; Electrolyte imbalance; Dengue severity; Mortality.

INTRODUCTION

Dengue fever is one of the most important mosquito-borne viral infections affecting tropical and subtropical regions worldwide. It is caused by four antigenically distinct serotypes of dengue virus (DENV 1–4), belonging to the genus

Flavivirus of the family *Flaviviridae*. [1,2] The disease is transmitted primarily by *Aedes aegypti* mosquitoes and presents as an acute febrile illness characterized by fever, headache, retro-orbital pain, myalgia, arthralgia, rash, leukopenia, and lymphadenopathy. [3,4]

Over the last few decades, dengue has emerged as a major global public health concern because of rapid urbanization, population growth, globalization, climate change, and ineffective vector control measures. [5,6] According to the World Health Organization (WHO), approximately 50 million dengue infections occur annually, and nearly 2.5 billion people living in endemic regions are at risk of infection. [7] Southeast Asia contributes significantly to the global burden of dengue infection, with India witnessing a substantial rise in cases and mortality in recent years. [8]

The clinical spectrum of dengue infection ranges from asymptomatic illness and uncomplicated dengue fever (DF) to severe forms such as dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). [9] While most patients recover uneventfully, a subset develops severe complications due to plasma leakage, bleeding manifestations, shock, and multiorgan dysfunction. [10] The pathogenesis of severe dengue is believed to involve immune-mediated endothelial dysfunction, cytokine storm, coagulation abnormalities, and increased vascular permeability. [11]

Electrolyte disturbances are commonly encountered in dengue infection and are considered important indicators of disease severity. [12] Among these, hyponatremia is one of the most frequent abnormalities observed in hospitalized dengue patients. [13] Hyponatremia may result from multiple mechanisms such as inappropriate antidiuretic hormone secretion, renal sodium loss, vomiting, poor oral intake, and plasma leakage secondary to increased capillary permeability. [14,15]

Hyponatremia in dengue infection has been associated with neurological manifestations, prolonged hospitalization, increased complications, and poor prognosis. [16] Several studies have reported a significant association between decreasing serum sodium levels and increasing severity of dengue infection, particularly in patients with DHF and DSS. [17–19] Early detection and prompt correction of electrolyte imbalances may therefore play an important role in reducing morbidity and mortality associated with dengue infection. [20]

Although various studies have evaluated electrolyte abnormalities in dengue fever, limited data are available regarding serum sodium levels and their correlation with dengue severity in tertiary care settings in India. Therefore, the present study was undertaken to estimate serum sodium levels among dengue patients and determine the association between hyponatremia and severity of dengue infection in a tertiary care centre.

MATERIALS AND METHODS

Study Design

This was a hospital-based cross-sectional observational study conducted to evaluate serum sodium levels among patients diagnosed with dengue fever and to determine the association between hyponatremia and severity of dengue infection.

Study Setting

The study was carried out in the Department of General Medicine at Malla Reddy Institute of Medical Sciences, Hyderabad, Telangana, India.

Study Duration

The study was conducted over a period of 16 months from September 2022 to December 2023.

Study Population

The study population included patients admitted to the Department of General Medicine with clinical suspicion or confirmed diagnosis of dengue fever during the study period.

Sample Size

The sample size was calculated using the formula:

$$N = \frac{Z^2 pq}{L^2}$$

Where:

- $Z=1.96$ at 95% confidence interval
- $p=57\%$ (prevalence of dengue infection based on previous literature)
- $q=1-p=43\%$
- $L=15\%$ allowable error

The calculated minimum sample size was 42. However, a total of 50 patients fulfilling the eligibility criteria were included in the study.

Inclusion Criteria

1. Patients aged more than 18 years.
2. Patients with confirmed dengue infection diagnosed by NS1 antigen positivity and/or dengue IgM or IgG serology.
3. Patients diagnosed with dengue fever, dengue hemorrhagic fever, or dengue shock syndrome.
4. Patients willing to participate and provide informed consent.

Exclusion Criteria

1. Patients aged below 18 years.
2. Patients with pre-existing chronic illnesses such as diabetes mellitus, hypertension, chronic kidney disease, or cardiac disease.
3. Pregnant and lactating women.
4. Patients with other conditions known to alter serum sodium levels independently.

Data Collection Procedure

All eligible patients admitted during the study period were screened and enrolled after obtaining informed written consent. A predesigned and pretested proforma was used to collect demographic details, clinical history, symptoms, examination findings, and laboratory parameters.

Detailed history regarding fever, myalgia, headache, vomiting, bleeding manifestations, abdominal pain, and other symptoms suggestive of dengue infection was recorded. General physical examination and systemic examination were performed in all patients.

Diagnosis of dengue infection was confirmed by serological tests including:

- NS1 antigen assay
- Dengue IgM antibody test
- Dengue IgG antibody test

Laboratory Investigations

The following investigations were carried out for all study participants:

- Complete blood count (CBC)
- Liver function tests (LFT)
- Renal function tests (RFT)
- Chest radiography
- Ultrasonography of abdomen
- Electrocardiography (ECG)
- Echocardiography
- Serum electrolyte analysis including serum sodium levels on admission and on the third day of hospitalization

Hyponatremia was defined as serum sodium level <135 mEq/L and was further classified as:

- Mild hyponatremia: 130–134 mEq/L
- Moderate hyponatremia: 125–129 mEq/L
- Severe hyponatremia: <125 mEq/L

Severity of dengue infection was classified according to WHO guidelines into dengue fever (DF), dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS).

Outcome Measures

The primary outcome measured was the prevalence of hyponatremia among dengue patients. Secondary outcomes included association of serum sodium levels with dengue severity, complications, and mortality.

Statistical Analysis

The collected data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 26.0. Qualitative variables were expressed as frequencies and percentages, while quantitative variables were expressed as mean \pm standard deviation (SD).

Chi-square test and independent t-test were used to determine the association between categorical and continuous variables. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 50 patients with confirmed dengue infection were included in the present study. The demographic profile, serological status, serum sodium levels, complications, severity of dengue infection, and outcomes were analyzed.

The age distribution of the study population showed that the majority of patients belonged to the 41–50 years age group (30%), followed by 31–40 years (24%). Patients aged 51–60 years and more than 60 years constituted 16% each, while 14% belonged to the 21–30 years age group. The mean age of the study participants was 45.3±14.7 years.

Table 1: Distribution of study participants according to age

Age group (years)	Frequency (n)	Percentage (%)
21–30	7	14
31–40	12	24
41–50	15	30
51–60	8	16
>60	8	16
Total	50	100

Mean age = 45.3 ± 14.7 years

Male predominance was observed in the study population. Out of 50 patients, 29 (58%) were males and 21 (42%) were females, with a male-to-female ratio of 1.8:1.

Table 2: Gender distribution of study participants

Gender	Frequency (n)	Percentage (%)
Male	29	58
Female	21	42
Total	50	100

Serological analysis revealed NS1 antigen positivity in 32 (64%) patients. IgM antibodies were positive in 40 (80%) patients, whereas IgG positivity was observed in 9 (18%) patients.

Table 3: Serological profile of dengue patients

Serological marker	Positive n (%)	Negative n (%)
NS1 Antigen	32 (64%)	18 (36%)
IgM Antibody	40 (80%)	10 (20%)
IgG Antibody	9 (18%)	41 (82%)

Assessment of serum sodium levels showed that 32 (64%) patients had hyponatremia, while 18 (36%) patients had normal serum sodium levels (>135 mEq/L). The mean serum sodium level among the study participants was 126.1±16.1 mEq/L.

Table 4: Distribution of serum sodium levels among dengue patients

Serum sodium level	Frequency (n)	Percentage (%)
>135 mEq/L	18	36
<135 mEq/L	32	64
Total	50	100

Mean serum sodium level = 126.1 ± 16.1 mEq/L

Among patients with hyponatremia, mild hyponatremia was the most common abnormality observed in 16 (32%) patients. Moderate hyponatremia was present in 6 (12%) patients, while severe hyponatremia was observed in 10 (20%) patients.

Table 5: Severity of hyponatremia among study participants

Hyponatremia status	Frequency (n)	Percentage (%)
No hyponatremia	18	36
Mild hyponatremia	16	32
Moderate hyponatremia	6	12
Severe hyponatremia	10	20
Total	50	100

The prevalence of complications among the study participants was 32%. Complications were more commonly observed among patients with severe hyponatremia followed by moderate hyponatremia. Bleeding manifestations were the most frequently observed complications. CNS involvement, respiratory complications, and hepatobiliary complications were also noted.

Table 6: Distribution of complications according to severity of hyponatremia

Hyponatremia status	Bleeding	CNS	Bleeding + CNS	Bleeding + RS	Bleeding + CNS + RS	Bleeding + Hepatobiliary	Total complications
No hyponatremia (n=18)	1	0	0	0	0	0	1

Mild hyponatremia (n=16)	1	0	0	0	0	0	1
Moderate hyponatremia (n=6)	2	1	0	1	0	0	4
Severe hyponatremia (n=10)	3	1	4	0	1	1	10
Total	7	2	4	1	1	1	16

Based on disease severity, the majority of patients had uncomplicated dengue fever. Among the 50 patients studied, 47 (94%) had dengue fever, 2 (4%) had dengue hemorrhagic fever, and 1 (2%) had dengue shock syndrome.

Table 7: Distribution according to severity of dengue infection

Dengue severity	Frequency (n)	Percentage (%)
Dengue fever	47	94
Dengue hemorrhagic fever	2	4
Dengue shock syndrome	1	2
Total	50	100

Outcome analysis showed that 47 (94%) patients recovered and were discharged, while mortality was observed in 3 (6%) patients.

Table 8: Outcome of study participants

Outcome	Frequency (n)	Percentage (%)
Discharged	47	94
Death	3	6
Total	50	100

Statistical analysis demonstrated a significant association between hyponatremia and severity of dengue infection ($p < 0.001$). Hyponatremia was also significantly associated with occurrence of complications ($p = 0.005$) and mortality ($p < 0.001$), indicating that decreasing serum sodium levels were associated with worsening clinical outcomes.

Table 9: Association between hyponatremia and clinical outcomes

Variable	Mean	SD	95% CI	p-value
Dengue severity	1.08	0.3	0.73–1.4	0.001*
Complications	1.68	0.4	0.1–0.8	0.005*
Outcome	1.06	0.2	0.7–1.4	0.001*

*Statistically significant ($p < 0.05$)

DISCUSSION

Dengue fever continues to be a major public health concern in tropical and subtropical countries due to its increasing incidence, recurrent outbreaks, and associated complications. Electrolyte abnormalities, particularly hyponatremia, have gained importance in recent years because of their association with disease severity and clinical outcomes. The present study was conducted to evaluate serum sodium levels among dengue patients and to determine the correlation between hyponatremia and dengue severity.

In the present study, the mean age of the study participants was 45.3 ± 14.7 years, and the majority of patients belonged to the 41–50 years age group. Male predominance was observed, with males constituting 58% of the study population. Similar findings were reported by Relwani et al.[21] and Verma et al.[22], who observed higher incidence of dengue among middle-aged adults and male patients. The increased prevalence among males may be attributed to greater outdoor exposure and occupational risk factors.

In the current study, NS1 antigen positivity was observed in 64% of patients, IgM positivity in 80%, and IgG positivity in 18% of patients. Similar serological patterns were reported by Bandaru et al.[23] and Anand et al.[24], who found NS1 antigen and IgM positivity to be the most common laboratory findings among dengue patients during the acute phase of infection.

Hyponatremia was the most common electrolyte abnormality identified in this study and was observed in 64% of patients. The mean serum sodium level among study participants was 126.1 ± 16.1 mEq/L. Mild hyponatremia was observed in 32% of patients, moderate hyponatremia in 12%, and severe hyponatremia in 20% of patients. These findings are comparable to studies conducted by Shankar et al.[25], Khandelwal et al.[26], and Shubhangi et al.[27], who also reported high prevalence of hyponatremia among dengue patients.

The occurrence of hyponatremia in dengue infection may be multifactorial. Proposed mechanisms include increased capillary permeability leading to plasma leakage, inappropriate secretion of antidiuretic hormone, renal sodium loss, gastrointestinal fluid loss due to vomiting, and inadequate oral intake.[28,29] Cytokine-mediated endothelial dysfunction and stress-related hormonal changes may further contribute to sodium imbalance in dengue patients.

In the present study, complications were observed in 32% of patients, and most complications occurred among patients with severe hyponatremia. Bleeding manifestations were the most common complications noted, followed by central nervous system involvement and respiratory complications. Similar observations were made by Rajalekshmy et al.[30] and Bandaru et al.[23], who reported that severe electrolyte imbalance was associated with increased risk of bleeding manifestations and neurological complications.

Regarding disease severity, 94% of patients had dengue fever, while dengue hemorrhagic fever and dengue shock syndrome were observed in 4% and 2% of patients, respectively. These findings are consistent with the studies by Shankar et al.[25] and Khandelwal et al.[26], who also reported uncomplicated dengue fever as the predominant clinical presentation.

The present study demonstrated a statistically significant association between hyponatremia and severity of dengue infection ($p < 0.001$). Patients with lower serum sodium levels had increased incidence of complications and poorer outcomes. Similar findings were reported by Verma et al.[22], Guruprasad et al.[31], and Utkarsh et al.[32], who concluded that decreasing sodium levels correlated with worsening severity of dengue infection.

Mortality in the present study was 6%, and all deaths were associated with severe hyponatremia and complicated dengue infection. Hyponatremia was significantly associated with mortality ($p < 0.001$). Similar findings were observed by Akshay et al.[33], who identified serum sodium as an important prognostic marker in dengue fever. Early identification and correction of electrolyte disturbances may therefore help reduce morbidity and mortality associated with dengue infection. The findings of the present study emphasize the importance of routine monitoring of serum sodium levels in dengue patients. Early recognition of hyponatremia can aid clinicians in identifying patients at risk of severe disease and complications, thereby facilitating prompt intervention and improved clinical outcomes.

CONCLUSION

Hyponatremia is a frequent electrolyte abnormality among dengue patients and is significantly associated with increased disease severity, complications, and mortality. Monitoring serum sodium levels in dengue patients can aid in early identification of high-risk patients and facilitate prompt therapeutic intervention. Routine assessment and correction of electrolyte imbalances should therefore be considered an essential component of dengue management.

REFERENCES

1. World Health Organization. Dengue: guidelines for diagnosis, treatment, prevention and control. New ed. Geneva: World Health Organization; 2009.
2. Tomashek KM, Sharp TM, Margolis HS, St Geme JW. Dengue. In: Kliegman RM, Stanton BF, St Geme JW, Schor NF, editors. Nelson textbook of pediatrics. 20th ed. Philadelphia: Elsevier; 2016. p. 1629-34.
3. Varavithya W, Manu P. Studies on dengue hemorrhagic fever II: Electrolyte study. J Med Assoc Thai. 1973;56(1):15-23.
4. Mekmullica J, Suwanphatra A. Serum and urine sodium levels in dengue patients. Southeast Asian J Trop Med Public Health. 2005;36(1):197-9.
5. Shivanthan MC, Rajapakse S. Dengue and calcium. Int J Crit Illn Inj Sci. 2014;4(4):314-6.
6. Vachvanichsanong P, Thisyakorn U, Thisyakorn C. Dengue hemorrhagic fever and the kidney. Arch Virol. 2016;161(4):771-8.
7. World Health Organization. Global strategy for dengue prevention and control 2012–2020. Geneva: WHO; 2012.
8. National Vector Borne Disease Control Programme. Dengue/DHF situation in India [Internet]. New Delhi: NVBDCP; 2023 [cited 2026 May 12]. Available from: <https://www.nvbdc.gov.in>
9. George R, Liam CK, Chua CT, Lam SK, Pang T, Geethan R, et al. Unusual clinical manifestations of dengue virus infection. Southeast Asian J Trop Med Public Health. 1988;19(4):585-90.
10. WHO Guidelines Approved by the Guidelines Review Committee. Dengue: guidelines for diagnosis, treatment, prevention and control. Geneva: World Health Organization; 2009.
11. Gupta E, Dar L, Kapoor G, Broor S. The changing epidemiology of dengue in Delhi, India. Virol J. 2006;3:92.
12. Futrakul P, Poshyachinda V, Mitrakul C, KunAnake C, Boonpucknavig V, Boonpucknavig S, et al. Renal involvement and reticulo-endothelial system clearance in dengue hemorrhagic fever. J Med Assoc Thai. 1973;56(1):33-9.
13. Vikram K, Nagpal BN, Pande V, Srivastava A, Saxena R, Anvikar A, et al. An epidemiological study of dengue in Delhi, India. Acta Trop. 2016;153:21-7.
14. Maheshwari M, Bansal R, Gupta S. Electrolyte profile of dengue infected patients: An observational study from a tertiary care centre in Rajasthan. Indian Pract. 2017;70(4):16-8.

15. Vachvanichsanong P, McNeil E. Electrolyte disturbance and kidney dysfunction in dengue viral infection. *Southeast Asian J Trop Med Public Health*. 2015;46(1):108-17.
16. Tomar LR, Raizada A, Yadav A, Agarwal S. Dengue fever presenting as hypokalemic muscle weakness. *Trop J Med Res*. 2016;19(1):76-8.
17. Jain RS, Gupta PK, Agrawal R, Kumar S, Khandelwal K. An unusual case of dengue infection presenting with hypokalemic paralysis with hypomagnesemia. *J Clin Virol*. 2015;69:197-9.
18. Caroline Rose P, Palanisamy A, Vijayaraman H. Electrolyte disturbance in dengue infected patients in Salem, Tamil Nadu. *Int J Adv Pharm Biol Chem*. 2019;3(4):933-6.
19. Nguyen MT, Ho TN, Nguyen VV, Nguyen TH, Ha MT, Ta VT, et al. An evidence-based algorithm for early prognosis of severe dengue in the outpatient setting. *Clin Infect Dis*. 2017;64(5):656-63.
20. Prakash R, Neelam N, Deepanshu G. Study of electrolytes in patients of dengue in a tertiary care hospital in India. *Int J Adv Med*. 2019;6(3):763-8.
21. Relwani PR, Sharma A, Gupta S, Meena R. Clinical profile and electrolyte disturbances in dengue fever patients admitted to a tertiary care centre. *Int J Med Res Rev*. 2019;7(5):401-7.
22. Verma SH, Pranjal P. Dyselectrolytemia in patients with dengue fever in tertiary care hospital. *Int J Adv Med*. 2021;8(6):760-3.
23. Bandaru AK, Reddy VK, Kumar PS. Electrolyte abnormalities in dengue fever and their association with disease severity. *Int J Contemp Med Res*. 2020;7(8):H1-5.
24. Anand AM, Kumar R, Singh P, Sharma M. Serological profile and clinical manifestations of dengue fever in adults. *J Assoc Physicians India*. 2020;68(7):45-9.
25. Shankar P, Nithya E, Kavya C. Study on electrolyte disturbances in dengue fever in a tertiary care centre. *IMSEAR*. 2019;204325.
26. Khandelwal VG, Patil V, Botre A, Patil R. Study of electrolyte disturbances in dengue infected patients. *Int J Curr Med Res*. 2019;6(2):B5-8.
27. Shubhangi H, Pranjal P. Serum sodium as a predictor of prognosis in dengue fever. *Int J Adv Med*. 2021;8(6):760-3.
28. Gurusprasad S. To study serum electrolytes and correlate with severity in patients with dengue. *IAR J Med Sci*. 2021;2(3):70-6.
29. Tayyaba A, Heena R, Saba S, Shaista E. Altered electrolyte homeostasis and severity of dengue fever. *Pak J Med Dent*. 2021;10(2):43-8.
30. Rajalekshmy M, Vadivelan M. Electrolyte abnormalities in patients with dengue infection admitted to a tertiary care teaching hospital in Southern India. *J Indian Acad Clin Med*. 2019;20(1):47-51.
31. Guruprasad S. Electrolyte disturbances in dengue fever and association with severity. *IAR J Med Sci*. 2021;2(3):70-6.
32. Utkarsh M, Mahesh M, Madhumitha M, Akshay P. Serum electrolytes and their prognostic value in dengue fever: A study from South India. *Eur Chem Bull*. 2023;12:4769-85.
33. Akshay A, Prasanth R, Pranam G, Usha P, Manjunath G. Serum sodium as a prognostic marker in dengue fever cases admitted to PICU in Navodaya Hospital, Raichur, India. *Int J Contemp Pediatr*. 2017;4(1):222-5.